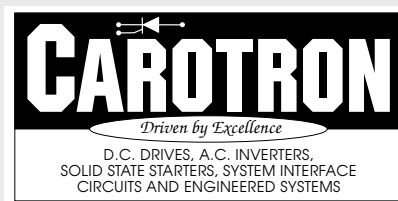


# Frequency to Voltage Converter Card

**Instruction Manual**  
**Model C10330-000**



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3204 Rocky River Road  
Heath Springs, SC 29058  
Phone: (803) 286-8614  
FAX: (803) 286-6063

# 1

# General Description

Model C10330-000 is designed to provide a means of converting digital pulse tachometer frequency signals to analog voltage suitable for tachometer feedback control or speed reference in motor control systems. Sine wave signals of 1 to 20 Volts peak at up to 10,000 Hz or square wave signals from 10 to 12 volts peak at up to 20,000 Hz may be used as an input. The frequency signal is optically isolated from the output circuitry so that the signal may be used with digital instrumentation which may be grounded.

Designed for use with Carotron non-regenerative and regenerative motor controls, Model C10330-000 may also be used with drives from other manufacturers if the feedback can be scaled to work with the nominal 10 VDC output range. For regenerative operation, a buffered armature voltage signal scaled for approximately 10 VDC at maximum armature voltage must be supplied for the polarity

switching circuit. This voltage must be positive with respect to circuit common when the drive requires positive tach feedback and negative when the drive requires negative tach feedback.

An isolated +12 VDC power supply rated at 100mA maximum is provided to supply encoders or magneto-resistor sensors. Input ranges of 60, 120, 240 and 600 pulses per revolution on 1750 base speed motors provide a nominal output range of 0 to 10 VDC. Multi-turn potentiometers for OFFSET and GAIN allow precise adjustment for the desired output.

For systems where the output voltage is to be used as a speed reference, terminals are supplied for an optional external TRIM pot. for either manual or dancer control. A single turn TRIM RANGE pot. is supplied on the C10330-000 unit to limit the range of the external TRIM pot.

# 2

# Specifications

## AC Input

115/230 VAC  $\pm 10\%$ , 50/60 Hz, 9.2 VA max.

## Isolation Voltage

460 VAC RMS, 1500 V PEAK

## Linearity

$\pm 0.2\%$  of span with output range of 0 to 10 VDC with a 100,000 Ohm load.

## Signal Inputs

Square Wave: 10 to 12 V PEAK at 20,000 Hz max.

Sine Wave: 1 to 20 V PEAK at 10,000 Hz max.

Buffered Armature:

0 to +10 VDC for positive output

0 to -10 VDC for negative output

## TRIM Pot.

An external 10,000 Ohm, 2 Watt pot. allows the output to be trimmed. A TRIM RANGE pot. on the C10330-000 unit controls the TRIM POT. range from a maximum of 0 to 100% or a minimum of 80 to 100%.

## Output

Typical output is 0 to  $\pm 10$  VDC for non-regen operation and -10 to +10 VDC for regen operation. The GAIN adjustment range, Jumper J3 and Jumper J1 allow a broad range of input frequencies to be used. Input type refers to the shape of the input signal. Encoder inputs are typically square wave. Magnetic pickup inputs are typically sine wave. The following table shows the relationship for V out/Fin with the noted jumper settings:

Input Type	Jumper J1	Jumper J3	V out/Fin Range
Sine/Square	+1	60 PPR	.004 to .020
Square	+2	60 PPR	.002 to .010
Sine/Square	+1	120 PPR	.002 to .010
Square	+2	120 PPR	.001 to .006
Sine/Square	+1	240 PPR	.001 to .005
Square	+2	240 PPR	.0005 to .0025
Square	+1	600 PPR	.0008 to .0040
Square	+2	600 PPR	.0004 to .0020

# 3 Description of Jumpers, Adjustments

## Jumper J 1

Selects between +1 or +2 for encoder input signals. The +2 selection allows frequencies between 10,000 and 20,000 Hz to be used in the encoder mode. When using the Magnetic Pickup input, J1 has no effect.

## Jumper J2

Selects between the Encoder and Magnetic Pickup inputs. Choose the Encoder position for square wave input signals and use terminal TB 1-8 for the input. For sine wave signals, select the Magnetic Pickup position and use T131-9 for the input.

## Jumper J3

Selects the pulse per revolution of the input Encoder or Magnetic Pick-up when using a 1750 base speed motor. Other pulse per revolution signals may be used. Refer to Section 2 for the V out/Fin range for each combination of jumpers.

## Jumper J4

Allows the output voltage to be tailored for Non-regen or Regen feedback. In the Non-regen position, the output voltage is typically 0 to +10VDC. In the Regen position, a buffered armature voltage switches the output polarity to allow the output to

vary between +10 VDC and -10 VDC. For operation as a frequency follower, use the Non-regen position.

## GAIN Pot. P1

Adjusts the maximum voltage output level with maximum input signal applied.

## OFFSET Pot. P2

Nulls the first stage amplifier with minimum input signal applied.

## TRIM RANGE Pot. P3

Used to set the range of adjustment for the optional external TRIM pot. Using a 10,000 Ohm TRIM pot., the TRIM RANGE pot. can set the range as wide as 0 to 100% or as narrow as 80 to 100%.

## TRIM Pot. (optional)

This function is optional when the unit is used as a frequency follower. The TRIM pot. allows the output voltage to be ratioed by either a manual or dancer operated potentiometer. The range of adjustment for the TRIM pot. is controlled by the TRIM RANGE pot. as described above.

# 4 Jumper Selection Procedure

The following procedure provides a method for determining which jumper positions to use for your application. Always select the proper jumper positions prior to starting the adjustment procedure.

## Jumper J2 Selection

- Select Jumper J2 based on the type of signal to be used as an input. For square wave signals, place J2 in the ENCODER position and refer to Connection Diagram D10364 for typical encoder connections. For sine wave signals, place J2 in the Mag. Pickup position and also refer to the Connection Diagram D10364 for typical magnetic pickup connections.

## Jumper J4 Selection

- Select Jumper J4 based on tach feedback operation with a non-regen or regen drive. Select the NON-REGEN position for Carotron ADP100 Series drives or other non-regen drives. Select the REGEN position for Carotron RCP200 Series drives or other regen drives.
- NOTE: The Regen position requires a buffered armature voltage signal on TBI-12 to control output polarity switching. This voltage must be referenced to terminal TBI-11 which is circuit common of the C 10330-000 card. This armature signal must also be scaled to provide a + 10 VDC

maximum input when a positive output voltage is desired from the C10330-000 card and -10 VDC maximum when a negative output is desired. The voltage at test point AFB on the Carotron RCP200 Series power board meets these conditions.

- For operation as a frequency follower, place Jumper J4 in the Non-regen position.

### Jumper J1 and J3 Selection

- Selection of Jumpers J1 and J3 are related to the maximum input frequency and desired output voltage. Section 2 on page 3 shows the range of V out/Fin for the combinations of jumper settings for the two types of input signals. With these ranges we can determine the proper selection of J1 and J3 that will allow the GAIN pot. to adjust for the desired output.
- For your application, begin by making note of the type of signal to be used (Square wave or Sine wave).
- Next calculate the maximum input frequency that you will use. Calculate the frequency as follows:

$$\frac{\text{Maximum Rotating Speed (RPM)} \times \text{Tach Pulses Per Revolution}}{60} = \text{Max. Freq. (Hz)}$$

#### Example:

Max. Rotating Speed = 1750 RPM  
 Encoder used has 600 Pulses Per Revolution  
 Input Freq. =  $\frac{1750 \times 600}{60} = 17,500 \text{ Hz}$

- Next decide what output voltage your application requires. Typical feedback for Carotron drives requires a magnitude of 10 VDC output. Calculate the value of V out/Fin for your application.

Refer to the ranges shown for V out/Fin in Section 2. Select a range that fits your input type and use the jumper settings shown in the chart. There may be multiple ranges that will work for your application. However, the best choice will be the range where your calculated value falls toward the middle of the range specified in the chart.

#### Example #1

Desired Voltage Output (V out) = 10 VDC  
 Max. Input Frequency (Fin) = 17,500 Hz  
 Input Type is a square wave (Encoder)

Calculate:

$$V \text{ out}/F_{in} = 10 \text{ VDC} / 17,500 \text{ Hz} = .00057$$

Two jumper settings will work. They are:

- J1 = +2, J3 = 240 PPR (.0005 to .0025)
- J1 = +2, J3 = 600 PPR (.0004 to .0020)

Selection (b.) is the best choice since our calculated value falls more toward the center of the range.

#### Example #2

Desired Voltage Output (V out) = 5 VDC  
 Max. Input Frequency (Fin) = 1,000 Hz  
 Input Type is a sine wave (MAG. PICKUP)

Calculate:

$$V \text{ out}/F_{in} = 5.0 \text{ VDC} / 1,000 \text{ Hz} = .005$$

For sine wave signals only the +1 selections are available. Two jumper settings will work. They are as follows:

- J1 = +1, J3 = 60 PPR (.004 to .020)
- J1 = +1, J3 = 120 PPR (.002 to .010)

Selection (b.) is the best choice since our calculated value falls more toward the center of the range.

## 5 Adjustment Procedure

After selecting the jumper locations per Section 4 and connecting the unit per Connection Diagram D10364, use the following information to begin adjustment of the C 10330-000 Frequency to Voltage Converter Card. The adjustment procedure is broken into two sections based on the type of application.

### For D.C. Tach Feedback Signal

- 9 Jumper TBI-13 to TBI-14 to bypass the optional external TRIM pot.
- With the motor control unit disabled or the output of the C10330-000 disconnected, apply power to the C10330-000 card.

- With zero input frequency, adjust the GAIN pot. (P 1) full clockwise (approximately 20 turns).
- Using a digital voltmeter, monitor the voltage between TP3 (common) and TP1. Adjust the OFFSET pot. (P2) until the meter reads 0.0 VDC.
- Remove AC power from the C10330-000 card.

### For Motor Controls With Armature Feedback

- If the motor control has an armature feedback mode, select armature feedback to make the initial GAIN adjustments. If no armature feedback mode is available, go to the section labeled FOR MOTOR CONTROLS WITH TACH FEEDBACK ONLY.
- With the motor control in armature feedback, enable the motor control or reconnect the output of the C10330-000.
- Start the motor and adjust for full speed. Adjust the GAIN pot (PI) for the desired output voltage between TBI-10 and TB1-11. Check the output voltage to be sure that the polarity is correct for feedback to the motor control (typically 10 VDC).
- If a regenerative control is being used, make sure that the output voltage polarity is correct and switches polarity when the motor reverses.
- Stop the motor and turn off the AC power. Switch the control to the tach feedback mode. Turn the speed reference to minimum. Turn the max. speed adjustment on the motor control to mid-range.
- Re-apply power and start the motor. Gradually increase the speed reference to maximum. If motor speed increases rapidly or becomes uncontrolled, stop the motor and check for a bad connection or reversed polarity.
- If the motor speed is too fast, use the max. speed pot. on the motor control to slow the motor down. If the speed is too slow, decrease the feedback voltage by adjusting the GAIN pot. on the C 10330-000 card counter-clockwise to speed up the motor.

### For Motor Controls With Tach Feedback Only

- Turn the speed reference to minimum. Turn the max. speed adjustment on the motor control to mid-range.

- Apply power and start the motor. Gradually increase the speed reference to maximum. If motor speed increases rapidly or becomes uncontrolled, stop the motor and check for a bad connection or reversed polarity.
- If the motor speed is too fast, use the max. speed pot. on the motor control to slow the motor down. If the speed is too slow, decrease the feedback voltage by adjusting the GAIN pot. on the C10330-000 card counter clockwise to speed up the motor.
- NOTE: If a regenerative control is being used, make sure that the output voltage polarity is correct and switches polarity when the motor reverses.

### For Frequency Follower

- If an external TRIM pot. is used, check connections per Connection Diagram D10364. Adjust the TRIM pot. full clockwise. Adjust the TRIM Range pot. (P3) for the desired range for the external TRIM pot. per the following chart:

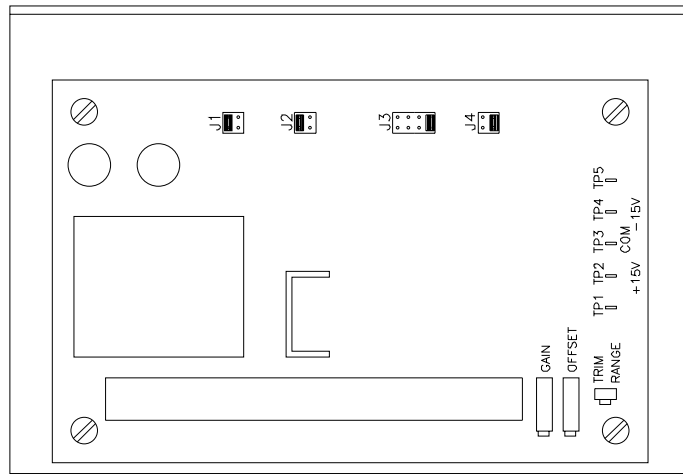
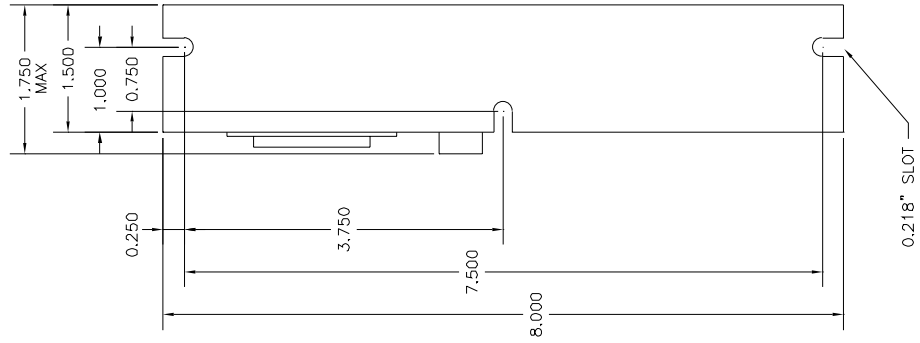
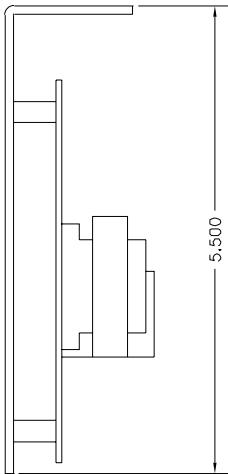
TRIM RANGE Pot. Setting	10K TRIM Pot. Adjustment Range
0% Clockwise	0 to 100%
25% Clockwise	55 to 100%
50% Clockwise	71 to 100%
100% Clockwise	83 to 100%

If no TRIM pot. is used, jumper TBI-13 to TB1-14.

- Apply AC power to the C 10330-000 card. Apply zero input or minimum input signal and adjust the GAIN pot. (PI) full clockwise (approximately 20 turns). Using a digital voltmeter, monitor the voltage between TP3 (common) and TP1. Adjust the OFFSET pot. (P2) until the meter reads 0.0 VDC.
- Apply full input signal. Adjust the GAIN pot. (PI) for the desired output voltage between TBI-10 (output) and TBI-11 (common). If the desired output voltage range cannot be achieved, refer to Section 4 to make sure that the proper jumper ranges were selected.
- Check the range of the TRIM pot. by monitoring the output voltage with full input frequency. Rotate the TRIM pot. counter clockwise. Readjust the TRIM RANGE pot. (P3) if necessary.

# 6

# Prints



REV. 10-15-98, DRAWN ON ACAD

DRAWN BY: HJH  
DATE: 10-15-98

APPROVED BY: DATE:

TOLERANCES =  
FRACTIONS: MAX  
DEC PL: .005

TITLE: DIMENSION DIAGRAM  
F TO V CARD  
C10330-000

SCALE:

DRAWING NUMBER: C10363

REV.:

SH. 1 OF 1

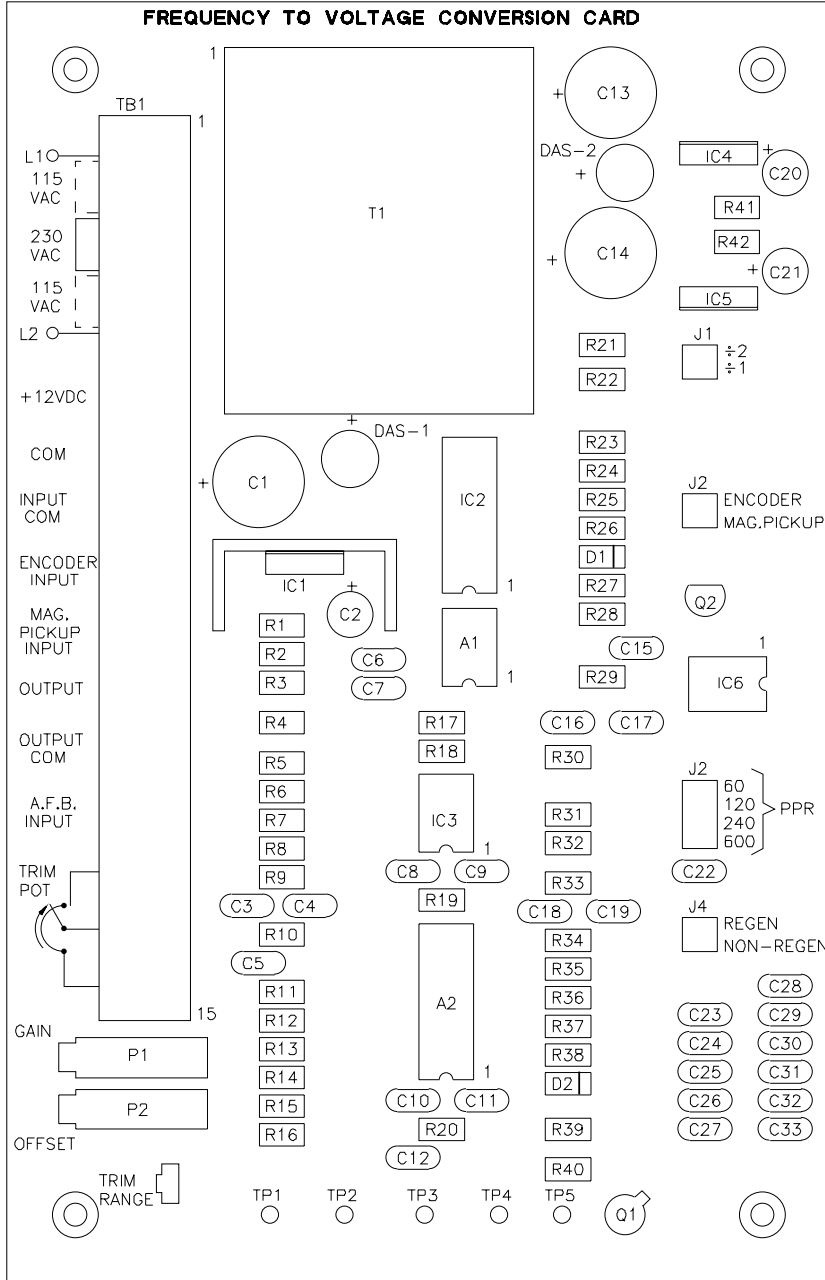


Driven by Excellence

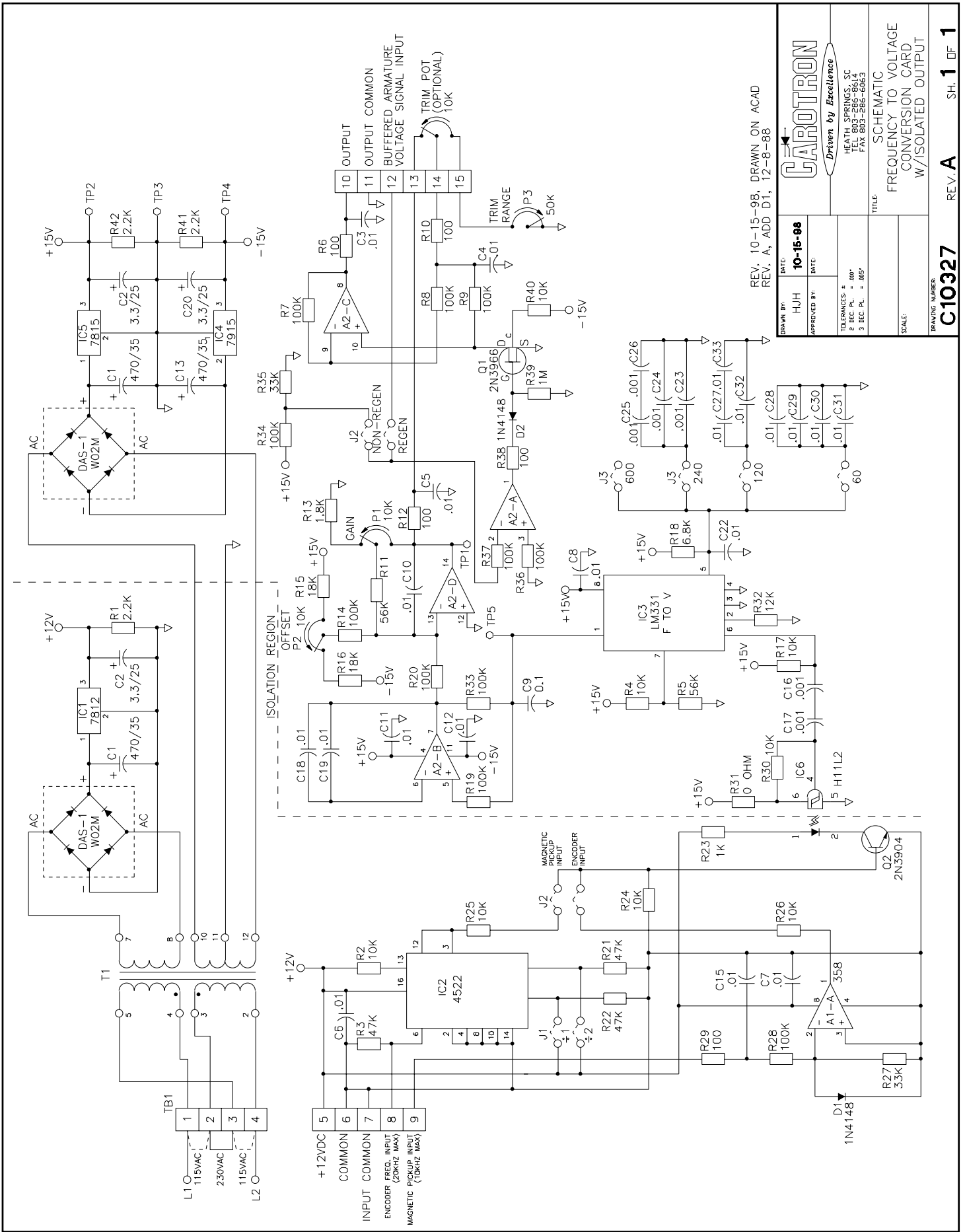
HEATH SPRINGS, SC  
TEL: 803-286-8614  
FAX: 803-286-8663

REV. 10-15-98, DRAWN ON ACAD

<i>Driven by Excellence</i>	
HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-8683	
TITLE: ASSEMBLY FREQUENCY TO VOLTAGE CONVERSION CARD W/ISOLATED OUTPUT	
DRAWN BY: HJH DATE: 10-15-98	APPROVED BY: _____ DATE: _____
TEL. RANGE: 1 = 000 2 = DEC. PL. = 0005 3 = DEC. PL. = 0005	SCALE: _____
DRAWING NUMBER: <b>C10330</b>	
REV. - SH. 1 OF 1	







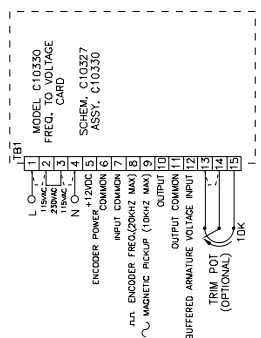
REV. 10-15-98, DRAWN ON ACAD  
 REV. A, ADD D1, 12-8-88

DRAWN BY:	HJH
DATE:	10-15-98
APPROVED BY:	
DATE:	
TOLERANCES:	* 0.00"
2 DEC. PL. =	0.00"
3 DEC. PL. =	0.005"

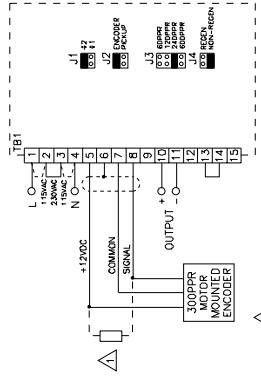
**CAROTRON**  
*Driven by Excellence*  
 HEATH SPRINGS, SC  
 FAX 803-586-6063

TITLE:  
 SCHEMATIC  
 FREQUENCY TO VOLTAGE  
 CONVERSION CARD  
 W/ISOLATED OUTPUT

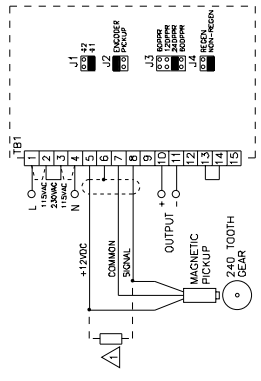
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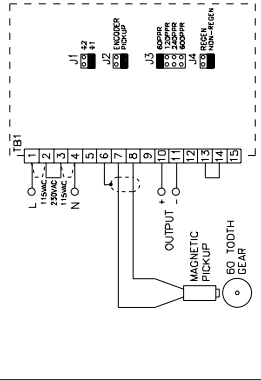
GENERAL CONNECTIONS



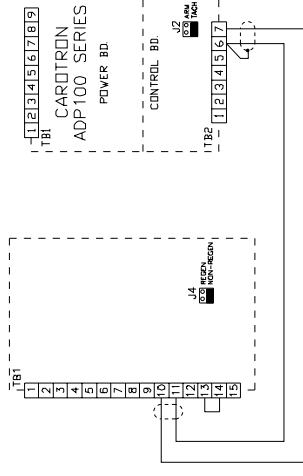
CONNECTION TO 300 PULSE PER REVOLUTION ENCODER



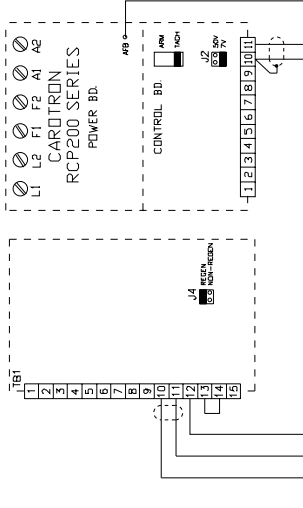
CONNECTION TO 240 PULSE PER REVOLUTION PICKUP OR RESOLVER



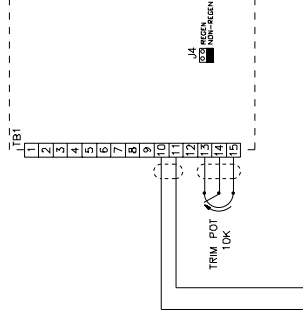
CONNECTION TO 60 PULSE PER REVOLUTION MAGNETIC PICKUP



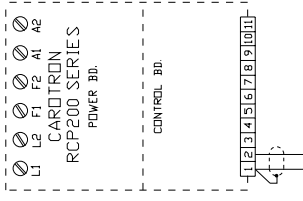
CONNECTION TO ADP100 SERIES CONTROL FOR SPEED FEEDBACK



CONNECTION TO RCP200 SERIES REGENERATIVE CONTROL FOR SPEED FEEDBACK



CONNECTION TO RCP200 SERIES TACH FOLLOWER WITH EXTERNAL TRIM



CONNECTION TO CARDTRON RCP200 SERIES POWER BOARD

REV. B. REDRAWN ON ACAD. 10-14-98  
 REV. A. ADDED PULL-UP RESISTORS 10-23-91

DESIGNER	HJH
DATE	10-14-93
APPROVED BY	AWC
TRAINER	HEATH SERVICES, INC. P.O. BOX 286-287-85
SCALE	1:1
TITLE	CONNECTION DIAGRAM MODEL C10330 FREQ. TO VOLTAGE CARD

PART NUMBER **D10364** REV B SH 1 OF 1

# Standard Terms & Conditions of Sale

## 1. General

The Standard Terms and Conditions of Sale of Carotron, Inc. (hereinafter called "Company") are set forth as follows in order to give the Company and the Purchaser a clear understanding thereof. No additional or different terms and conditions of sale by the Company shall be binding upon the Company unless they are expressly consented to by the Company in writing. The acceptance by the Company of any order of the Purchaser is expressly conditioned upon the Purchaser's agreement to said Standard Terms and Conditions. The acceptance or acknowledgement, written, oral, by conduct or otherwise, by the Company of the Purchaser's order shall not constitute written consent by the Company to addition to or change in said Standard Terms and Conditions.

## 2. Prices

Prices, discounts, allowances, services and commissions are subject to change without notice. Prices shown on any Company published price list and other published literature issued by the Company are not offers to sell and are subject to express confirmation by written quotation and acknowledgement. All orders of the Purchaser are subject to acceptance, which shall not be effective unless made in writing by an authorized Company representative at its office in Heath Springs, S.C. The Company may refuse to accept any order for any reason whatsoever without incurring any liability to the Purchaser. The Company reserves the right to correct clerical and stenographic errors at any time.

## 3. Shipping dates

Quotation of a shipping date by the Company is based on conditions at the date upon which the quotation is made. Any such shipping date is subject to change occasioned by agreements entered into previous to the Company's acceptance of the Purchaser's order, governmental priorities, strikes, riots, fires, the elements, explosion, war, embargoes, epidemics, quarantines, acts of God, labor troubles, delays of vendors or of transportation, inability to obtain raw materials, containers or transportation or manufacturing facilities or any other cause beyond the reasonable control of the Company. In no event shall the Company be liable for consequential damages for failure to meet any shipping date resulting from any of the above causes or any other cause.

In the event of any delay in the Purchaser's accepting shipment of products or parts in accordance with scheduled shipping dates, which delay has been requested by the Purchaser, or any such delay which has been caused by lack of shipping instructions, the Company shall store all products and parts involved at the Purchaser's risk and expense and shall invoice the Purchaser for the full contract price of such products and parts on the date scheduled for shipment or on the date on which the same is ready for delivery, whichever occurs later.

## 4. Warranty

The Company warrants to the Purchaser that products manufactured or parts repaired by the Company, will be free, under normal use and maintenance, from defects in material and workmanship for a period of one (1) year after the shipment date from the Company's factory to the Purchaser. The Company makes no warranty concerning products manufactured by other parties.

As the Purchaser's sole and exclusive remedy under said warranty in regard to such products and parts, including but not limited to remedy for consequential damages, the Company will at its option, repair or replace without charge any product manufactured or part repaired by it, which is found to the Company's satisfaction to be so defective; provided, however, that (a) the product or part involved is returned to the Company at the location designated by the Company, transportation charges prepaid by the Purchaser; or (b) at the Company's option the product or part will be repaired or replaced in the Purchaser's plant; and also provided that (c) the Company is notified of the defect within one (1) year after the shipment date from the Company's factory of the product or part so involved.

The Company warrants to the Purchaser that any system engineered by it and started up under the supervision of an authorized Company representative will, if properly installed, operated and maintained, perform in compliance with such system's written specifications for a period of one (1) year from the date of shipment of such system.

As the Purchaser's sole and exclusive remedy under said warrant in regard to such systems, including but not limited to remedy for consequential damages, the Company will, at its option, cause, without charges any such system to so perform, which system is found to the Company's satisfaction to have failed to so perform, or refund to the Purchaser the pur-

chase price paid by the Purchaser to the Company in regard thereto; provided, however, that (a) Company and its representatives are permitted to inspect and work upon the system involved during reasonable hours, and (b) the Company is notified of the failure within one (1) year after date of shipment of the system so involved.

The warranties hereunder of the Company specifically exclude and do not apply to the following:

a. Products and parts damaged or abused in shipment without fault of the Company.

b. Defects and failures due to operation, either intentional or otherwise, (1) above or beyond rated capacities, (2) in connection with equipment not recommended by the Company, or (3) in an otherwise improper manner.

c. Defects and failures due to misapplication, abuse, improper installation or abnormal conditions of temperature, humidity, abrasives, dirt or corrosive matter.

d. Products, parts and systems which have been in any way tampered with or altered by any party other than an authorized Company representative.

e. Products, parts and systems designed by the Purchaser.

f. Any party other than the Purchaser.

The Company makes no other warranties or representation, expressed or implied, of merchantability and of fitness for a particular purpose, in regard to products manufactured, parts repaired and systems engineered by it.

## 5. Terms of payment

Standard terms of payment are net thirty (30) days from date of the Company invoice. For invoice purposed, delivery shall be deemed to be complete at the time the products, parts and systems are shipped from the Company and shall not be conditioned upon the start up thereof. Amounts past due are subject to a service charge of 1.5% per month or fraction thereof.

## 6. Order cancellation

Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either party, the Purchaser shall pay to the Company the reasonable costs, expenses, damages and loss of profit of the Company incurred there by, including but not limited to engineering expenses and expenses caused by commitments to the suppliers of the Company's subcontractors, as determined by the Company.

## 7. Changes

The Purchaser may, from time to time, but only with the written consent of an authorized Company representative, make a change in specifications to products, parts or systems covered by a purchase order accepted by the Company. In the event of any such changes, the Company shall be entitled to revise its price and delivery schedule under such order.

## 8. Returned material

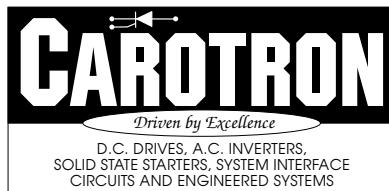
If the Purchaser desires to return any product or part, written authorization thereof must first be obtained from the Company which will advise the Purchaser of the credit to be allowed and restocking charges to be paid in regard to such return. No product or part shall be returned to the Company without a "RETURN TAG" attached thereon which has been issued by the Company.

## 9. Packing

Published prices and quotations include the Company's standard packing for domestic shipment. Additional expenses for special packing or overseas shipments shall be paid by the Purchaser. If the Purchaser does not specify packing or accepts parts unpacked, no allowance will be made to the Purchaser in lieu of packing.

## 10. Standard transportation policy

Unless expressly provided in writing to the contrary, products, parts and systems are sold f.o.b. first point of shipment. Partial shipments shall be permitted, and the Company may invoice each shipment separately. Claims for non-delivery of products, parts and systems, and for damages thereto must be filed with the carrier by the Purchaser. The Company's responsibility therefor shall cease when the carrier signs for and accepts the shipment.



**3204 Rocky River Road  
Heath Springs, SC 29058  
Phone: (803) 286-8614  
FAX: (803) 286-6063**

**MAN 1017-0C  
Issued 11-15-98**